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~~CONFIDENTIAL~~Caching, Weapons
Burial Container

October 18, 1957

10/23/57
9:00HB
Joe 25X1

Dear Sir:

This summary letter report describes the work done under Work Order No. XIII, Task Order No. A, during the period from June 28 through September 27, 1957.

During this period, the three prototype rectangular-cross-sectioned containers developed under Task Order No. D were cycle-tested to determine their ability to remain watertight while under water and subjected to specified changes in internal pressure. Although no leaking occurred under these conditions, air bubbles escaped from the pressurized containers past the O-ring seal. Stiffening members were added to one of the containers and this modification stopped the bubbling. Vacuum tests, which simulated an external pressure of 6 feet of water, were made on the modified container to insure that the stiffening members would not deform under such conditions. Also, a proposal was outlined to cover the fabrication of 10 prototype containers that would include the stiffening members and any other necessary modifications.

On May 29, 1956, Task Order No. D was undertaken to develop a rectangular-cross-sectioned underground-burial container which was expected to satisfy several requirements. These requirements are described in detail in our proposal dated April 23, 1956. The effort on this program resulted in three prototype containers which satisfied the originally indicated requirements. During May, 1957, the Sponsor inspected the prototype containers and suggested that certain further evaluation of the

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containers would be desirable. As a result, Work Order No. XIII, Task Order No. A, was undertaken on June 28, 1957.

The object of this research program was to investigate the ability of the prototype containers to remain watertight while under water and subjected to selected changes in internal pressure. Under actual service conditions, it is expected that temperature variations of from 0 to 100 F would normally occur in the vicinity of the containers. If a container were closed at a temperature of 70 F and then the temperature dropped to 0 F, a vacuum of 2 psi would be created inside the container; an increase in temperature to 100 F would create a pressure of 0.9 psi inside the container. In order to insure that these temperature-caused pressure variations would not result in container leakage, we placed the empty prototype containers under water and cycled them between a 3-1/2-psi vacuum and a 3-psi pressure.

The equipment used for the pressure-cycling experiments is shown in Figure 1. It consisted of a pressure-vacuum gage connected on the left to a high-pressure air source through a pressure-regulating valve, and on the right to a vacuum pump through a hand-operated control valve. The third connection at the gage was a rubber hose to the test container. In addition to the pressure source and vacuum pump, a tank of water, which is shown at the left in Figure 1, was used for immersion of the containers during cycling. Before a container was submerged in the water, the inside of the container was dusted with talc. Thus, the entrance of water into the container would be clearly indicated by a disturbance of the talc layer.

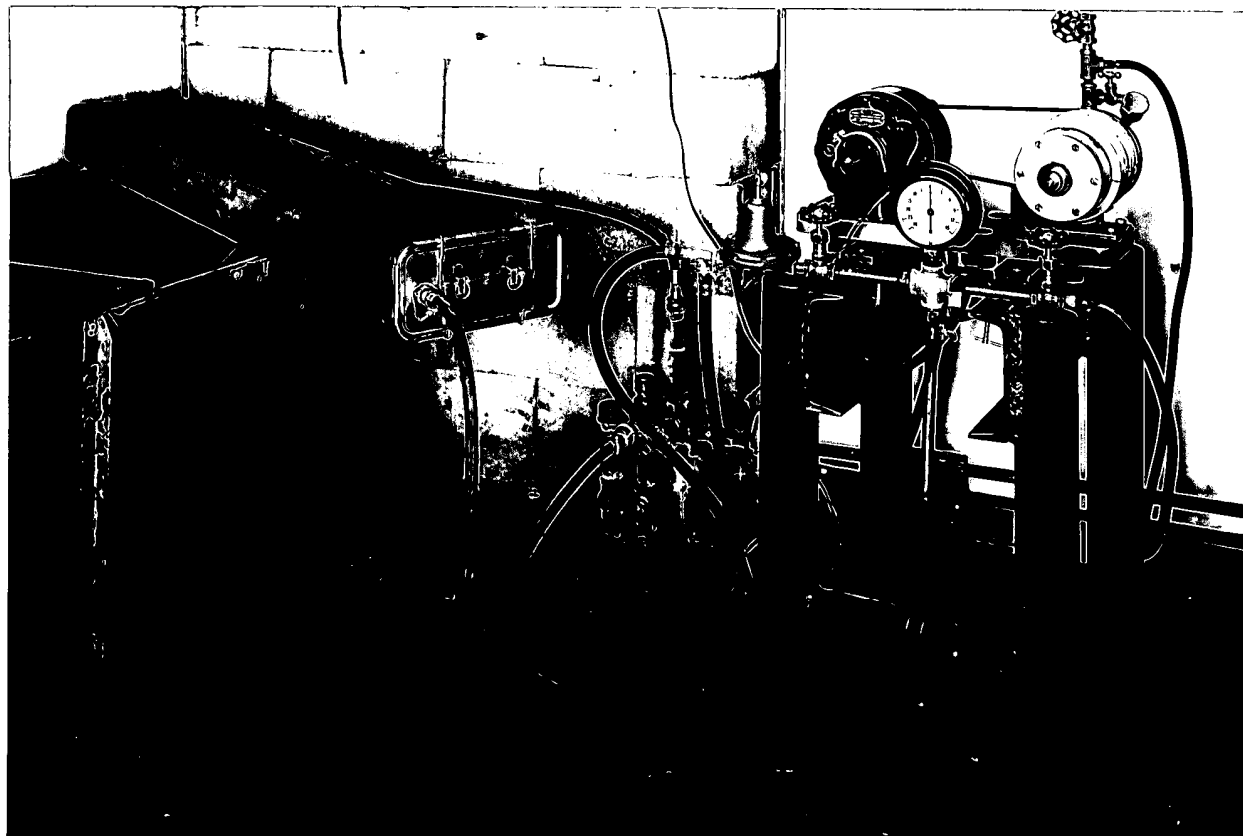
In order to simulate the expected service pressure variations, we cycled the pressure in the containers slowly. Cycling was started by in-

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Figure 1. Pressure-Cycling Equipment

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creasing the pressure in the container from atmospheric pressure to 3 psi over a period of 7-1/2 minutes. The container was held at this internal pressure for 5 minutes and then reduced to atmospheric pressure over another 7-1/2-minute period. Then, the internal pressure of the container was decreased to a 3-1/2-psi vacuum over a period of 7-1/2 minutes, held for 5 minutes, and increased to atmospheric during another 7-1/2-minute period. Six cycles a day were run on one of the prototype containers for 5 days, with examinations for water leakage at the end of each day's cycling. Six cycles were also run on each of the two remaining prototype containers, fabricated under Task Order No. D, to verify the results obtained with the first container.

The periodic examinations of the containers after each set of 6 cycles showed that no water had entered the containers. We were pleased to observe that no leakage had occurred in the container that had been permanently deformed during the strength tests conducted under Task Order No. D, when this container had been checked at a depth of 14.5 feet of water (6.5-psi pressure). Although no evidence of water leakage was noted for any of these containers, air loss from the containers, in the form of bubbling, was first observed at a pressure of about 1-1/2 psi, with a decrease in bubbling as the pressure was increased to 3 psi. All of the bubbling occurred along approximately 6 inches of the O-ring seal on the 9-inch sides of the containers.

Although the cycling tests showed that the air bubbling from the containers did not allow water to enter the containers, the Sponsor requested that an effort be made to stop this bubbling. At first, it was assumed that the bubbling resulted from deflection of the flange when the

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container was pressurized. However, calculations of the beam strength of the flange showed that a pressure of 3 psi would deflect the flange only 0.0035 inch, and this would be easily compensated for by the O-ring. Further calculations showed that the metal at the O-ring seal, which is located 7/16 inch below the top of the flange, would deflect 0.024 inch and this could not be taken up by the O-ring.

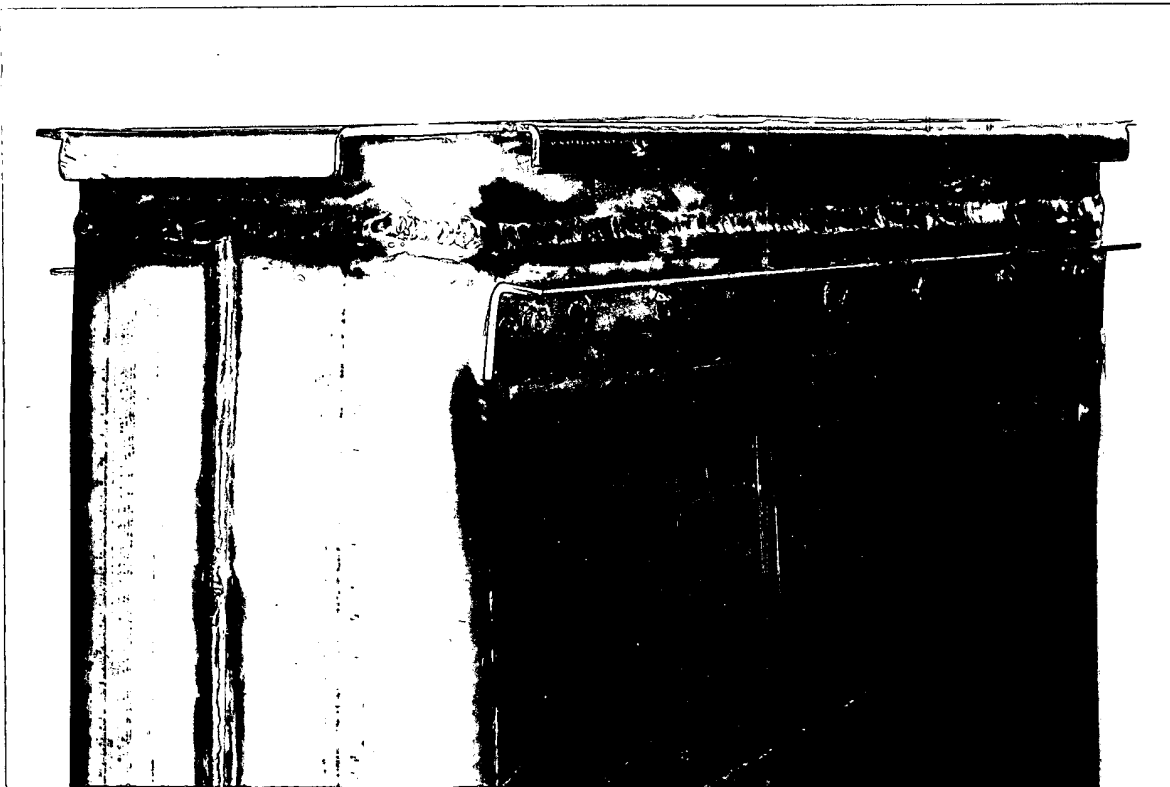
In an attempt to prevent the container from deflecting at the O-ring location, a heavier closure clamp was used. This measure was unsuccessful because the clamp did not support the sides of the container below the O-ring sealing line where support was needed. Next, two 3/8 x 3/4 x 8-inch angles were fabricated from 16-gage stainless steel sheet metal and spotwelded to the sides of the container, as shown in Figure 2; the top edge of each angle was located just below the welded junction of the flange and shell. Pressure tests on this modified container showed that the addition of the angle supports successfully prevented bubbling.

Since it was necessary to add the reinforcing angles in order to prevent bubbling when the container was pressurized, the question arose as to whether these angles would withstand permanent deformation when the container was subjected to an external hydrostatic pressure corresponding to immersion in 6 feet of water (the maximum expected external pressure). To determine the answer to this question, we ran vacuum tests on the container that simulated 6 feet of water pressure. No permanent deformation occurred in the angle reinforcing members or in the container under 6 feet of simulated water pressure.

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Figure 2. A Prototype Container With Stiffening Members Attached Externally to the Shell in a Location Corresponding to the O-Ring Seal Position

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In accordance with a recent discussion with the Sponsor, a proposal has been outlined that provides for the preparation of 10 rectangular-cross-sectioned prototype containers which would include the stiffening members and other necessary modifications; an investigation of the effectiveness of molded O-rings and the preparation of specifications and drawings of the containers would also be included in this program. This proposal will be transmitted to the Sponsor in the near future.

We would appreciate any comments that you or your associates might care to make with regard to the research.

Sincerely,



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ABW:dp

In Triplicate

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